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ABSTRACT

The purpose of this study was to determine the effects of three electronic text variables (run-around, wrap-around, and transparent text) on reading speed and comprehension. One hundred thirty-two undergraduate students in an introductory computer literacy course at a major university were asked to read one of three randomly-distributed passages consisting of approximately six pages of informative text about hypercard and desktop publishing. All reading materials included the same text and graphics but each set utilized a different text wrap. Pre- and posttests were used to measure students' comprehension of the reading material. The posttest contained an additional six-question attitude section including questions regarding the students' judgment of the difficulty of the content, the degree to which the graphics interfered with their comprehension and reading speed, their degree of interest in the subject, and their overall understanding of the material after reading it. Although analysis of variance indicated no significant differences for either reading comprehension or speed among the three groups, it appears that the wrap-around group had a higher mean gain than the transparent group, which in turn had a higher mean gain than the run-around group. Second, it appears that the wrap-around group also had the fastest reading speed, followed by the run-around group and then the transparent group. Because a significant difference in both reading speed and comprehension was found between the run-around and wrap-around treatment groups in a prior study, a replication of this study is recommended. (15 references) (GL)

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Title:

Visual Discrimination, Learning, and Page Layout: Wrap-Around, Run-Around, and Transparent Text

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Visual Discrimination, Learning, and Page Layout: Wrap-Around, Run-Around, and Transparent Text

As desktop publishing revolutionizes printing and publication, sophisticated computer programs offer the novice a wide range of techniques formerly available only to professional layout artists. Now anyone can design and produce their own instructional materials by transforming existing art into professional quality work that can be pasted into any variety of text formats.

Several popular software programs are noted for versatility and ease of layout design. They not only feature run-around text, but now boast wrap-around text and transparent text features as well. Run-around text is that which is "boxed" around the graphic, maintaining a square border around the visual (see Figure 1). Wrap-around text is that which flows smoothly around the graphic and "hugs it tight", leaving an irregularly shaped border (See Figure 2). Transparent text is that which has a graphic laid over it; the reader reads the text through the graphic (See Figure 3). These formatting features are described by software publishers as desirable software advancements, which allow the designer to quickly and rapidly communicate ideas to the reader. Examples of the use of run-around, wrap-around, and transparent text can be found in consumer magazines, newspapers, and instructional materials. In many instances, legibility appears severely restricted by the haphazard mixture of text and graphics.

Desktop publishing computer programs have individualized the page layout process and have provided sophisticated graphic enhancements for computer users who have no training in either instructional development, page layout, or graphic design. People who use such computer software to design instructional materials are faced with a vast array of newly developed features with no guidelines for their effective use. Guidelines are sometimes provided but they are often confusing. In one guide to basic design, a designer is told to "Frame your pictures with white space...White space separates headlines from surrounding body copy and artwork, making headlines easier to read" (Parker, 1987, pp 42-43). The examples show both run-around and wrap-around features being used.

Teachers and trainers who use computer programs to design instructional materials and integrate visuals in the text are asking for guidelines. How do these new desktop publishing enhancements affect the legibility of text? What is the optimal placement of text and graphics? How and where should white space be located to enhance reading comprehension? At what point does the integration of the text and visual

FIGURE 1
Run-Around Text

In terms of documentation they all do a good job, but *PageMaker* is by far the hardest program to learn to use. For users already familiar with *PageMaker* on the Mac, there will be instant recognition — it's the same program with improvements. For people who haven't struggled to learn it already, they have a long learning time ahead of them. *Spellbinder*, too, requires a long learning period. It's not as complicated as *PageMaker*, but the dot-command structure makes it less intuitive than a program that uses a mouse and icons. With *Spellbinder*, I had to constantly refer to the manual to look up commands, whereas with *Pagemaker*, I had difficulty just going through the complex menu choices. *Ventura* was relatively easy to learn, allowing me to feel in control of the program after a much shorter time. In fact, *Ventura* gave me almost as much pleasure in the thrill of discovery followed by quick satisfaction as *Clickart* did when I first used it. If I had used *Ventura* before *Clickart*, I think I would have been disappointed with *Clickart*.

FIGURE 2
Wrap-Around Text

In terms of documentation they all do a good job, but *PageMaker* is by far the hardest program to learn to use. For users already familiar with *PageMaker* on the Mac, there will be instant recognition — it's the same program with improvements. For people who haven't struggled to learn it already, they have a long learning time ahead of them. *Spellbinder*, too, requires a long learning period. It's not as complicated as *PageMaker*, but the dot-command structure makes it less intuitive than a program that uses a mouse and icons. With *Spellbinder*, I had to constantly refer to the manual to look up commands, whereas with *Pagemaker*, I had difficulty just going through the complex menu choices. *Ventura* was relatively easy to learn, allowing me to feel in control of the program after a much shorter time. In fact, *Ventura* gave me almost as much pleasure in the thrill of discovery followed by quick satisfaction as *Clickart* did when I first used it. If I had used *Ventura* before *Clickart*, I think I would have been disappointed with *Clickart*.

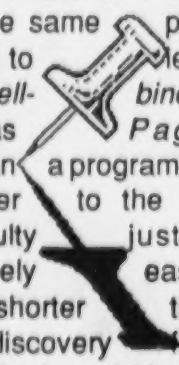

FIGURE 3
Transparent Text

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adversely affect legibility? How close to the visual should the text be placed?

PURPOSE OF THE STUDY

The purpose of this study was to determine the effects of three electronic text variables, run-around, wrap-around, and transparent text, on reading speed and comprehension. Results mights suggest some guidelines for the placement of graphics within electronic text.

Many researchers have investigated layout, typographic cueing, and presentation of graphic materials in instructional text. For example, Hartley (1985) determined that page size affects other layout decisions. Recent studies comparing the effects of justified and unjustified text are inconclusive. For example, Jonassen (1982) reported that in some circumstances, right justified text inhibited comprehension when compared to unjustified text. Yet, Campbell et al. (1981) and Muncer et al. (1986) determined that reading speed and comprehension were not significantly influenced by justification versus nonjustification. Jandreau et al. (1986) investigated the effects of varying spaces between phrases in sentences. And, others have examined certain design features common to printed and electronic text in the presentation of graphic materials (Alesandrini, 1987; Poggenpohl,1985; Winn,1987; Winn & Holliday, 1982). Graphics designers emphasize the importance of using

white space for balancing text, positioning graphics as the dominant visual element, and improving the aesthetics of the page layout (Parker, 1987). And, in 1987, Hartley, Isaacs, and others noted a need for published research on the effect of various text-wrap enhancements with either printed or electronic text. There is little reported research on graphic placement in instructional text and none that has produced guidelines for instructional use of graphics with the emerging computer software programs.

Although certain features of electronic text can be transferred to printed text, there are many differences between the two which suggest that separate studies be conducted. The size of the screen or page, the type size, and the ability to scroll are but a few of the differences which affect print and electronic text comparison studies. Because of these differences, a programmatic series of investigations is needed to examine the effects of these recent technological enhancements in each of the two media formats.

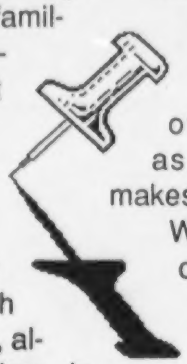
Knupfer and McIsaac (1988) responded to that need by studying the effect of run-around and wrap-around text, within one and two column formats, on reading speed and comprehension. That study found that the number of columns had no significant effect, however the text wrap did make a significant difference. Reading speed was faster and comprehension was better with wrap-around text, as shown in Figure 2, than with run-around text, as shown in Figure 1. In a follow-up study, Knupfer and McIsaac (1989) tried to determine if that difference was due to the amount of white space between the graphic and the text, or due to the shape of the white space surrounding the graphic. The follow-up study tested the variable of white space between the graphic and text by comparing two sets of reading materials which both used wrap-around text only; the difference was that one wrapped the text tightly against the graphic, as shown in Figure 2, while the other conformed the text to the shape of the graphic but left approximately one quarter inch of white space between the graphic and the text, as shown in Figure 4. There were no significant differences between wrap-around text with no white space and wrap-around text with one quarter inch of white space.

This study continues the investigation of text-wrap variables by adding an additional text-wrap feature, transparent text. If the results prove similar, guidelines should then be established to assist teachers and trainers in the appropriate use of this new type of desktop publishing feature. It is hypothesized that the previous results will be replicated and further, that the transparent text will show greater interference with reading speed and comprehension.

Recent work by Morrison, Ross and O'Dell (1988) examined attributes of computer based instruction, and attempted to affect certain attributes by regulating text density for print and screen display lessons. Results suggested that print had more advantages than the computer

FIGURE 4
Wrap-Around Text With One Quarter Inch White Space

In terms of documentation they all do a good job, but *PageMaker* is by far the hardest program to learn to use. For users already familiar with *PageMaker* on the Mac, there will be instant recognition — it's the same program with improvements. For people who haven't struggled to learn it already, they have a long learning time ahead of them. *Spellbinder*, too, requires a long learning period. It's not as complicated as *PageMaker*, but the dot-command structure makes it less intuitive than a program that uses a mouse and icons. With *Spellbinder*, I had to constantly refer to the manual to look up commands, whereas with *Pagemaker*, I had difficulty just going through the complex menu choices. *Ventura* was relatively easy to learn, allowing me to feel in control of the program after a much shorter time. In fact, *Ventura* gave me almost as much pleasure in the thrill of discovery followed by quick satisfaction as *Clickart* did when I first used it. If I had used *Ventura* before *Clickart*, I think I would have been disappointed with *Clickart*.



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screen in achievement, completion time, and learning efficiency for a statistics lesson. Therefore, the present study is limited to the examination of print-based, computer-generated text .

METHOD

Subjects.

One hundred, thirty-two undergraduate students from an introductory computer literacy course at a major university in the Southwest, participated in the study. The elective course was a 400 level course which was offered to meet a General Studies numeracy requirement. Students were sophomores, juniors, and seniors who had little or no previous exposure to computers. The study was conducted at the beginning of the semester and all students in the course participated. Students had little or no prior knowledge about the topic presented in the study materials.

Materials.

Readings. Readings included approximately six pages of informative text about hypercard and desktop publishing. These

materials were chosen because the topic was relevant to the subjects and because the reading level was geared for the general public as opposed to technical readers. The topic was suited to a novice audience with no prior knowledge about either hypercard or desktop publishing. The text was analyzed using the Flesch-Kincaid Readability formula and was found suitable for college students at the 11th and 13th grade levels.

Three sets of reading materials were used for this study. All included the same text and graphics arranged in single column format, but each set utilized a different text wrap respecting the graphic. The three sets included one with straight-framed graphics (see Figure 1, Run-Around Text), one with text tightly fitted around the graphics (see Figure 2, Wrap-Around Text), and one in which the graphic was placed directly over the text (see Figure 3, Transparent Text).

Although the graphics placement within these three sets of reading materials might not follow all of the elements of good design, it is important to know that the way in which they were developed is indicative of what practitioners will design. A sixth grade teacher who had a masters degree in the design and utilization of educational media, and who helped to instruct a desktop publishing course, was very much involved in the design of these reading materials. Therefore, any flaws in the materials design are potential problems that other teachers and trainers might exhibit as well.

Pretest and Posttest. To measure the students' comprehension of the reading material, a pretest and a posttest were developed from key concepts which the authors extracted from the readings. No test items were dependent upon the information contained in the graphics. The tests were developed and validated during a previous phase of the project, and were found to be reliable at the .76 level. The pretest and posttest were identical with one exception; the posttest contained an additional six-question attitude section. The attitude section included questions regarding the students' judgement of the difficulty of content, the degree to which graphics interfered with their comprehension and reading speed, their degree of interest in the subject, and their overall understanding of the material after reading it. These attitude questions were measured on a Likert-type scale and were not included in the posttest comprehension score.

Procedure.

All subjects were given a pretest to determine their knowledge of the subject prior to reading. There was no time limit and students were free to take the time they needed to complete the test. Next, the three sets of reading materials were randomly distributed to the students so that each student received one set of articles. Students were instructed to read through the text one time without hurrying. When subjects were finished reading, each of their reading times was recorded. Immediately following the reading, the subjects were given the posttest for

comprehension. They were allowed as much time as they needed to complete the test.

RESULTS AND CONCLUSIONS

The design of the study was an analysis of variance. The independent variable was the text-graphic format (run-around, wrap-around, or transparent text) and the dependent measures included reading speed and gain in comprehension as measured by the difference between the pretest and posttest scores. The alpha level for significance was set at .05.

Table 1 shows the mean scores for the pretest, posttest, gain, and time elapsed for each of the treatment groups. Although the ANOVA showed no significant difference in either comprehension or speed among the three treatment groups, the table does show some patterns that may be worth noting. First, it appears that the wrap-around treatment group had a higher mean gain than the transparent treatment group, which in turn had a higher mean gain than the run-around treatment group. Second, it appears that the wrap-around treatment group also had the fastest reading speed, followed by the run-around group and then the transparent group. We can conclude that the wrap-around treatment group had the best comprehension and the fastest reading time, even though those results are not outstanding enough to be statistically significant.

TABLE 1
Mean Scores

	Pretest	Posttest	Gain	Time
Run-Around	13.85	45.47	31.62	13.74
Wrap-Around	13.55	51.91	38.36	12.59
Transparent	12.57	47.76	35.19	14.51

We might consider the possibility of interference in the scores of the transparent text group. Although the three text-wrap forms were randomly distributed, the transparent group started off with a mean pretest score that was a full point lower than the other two groups. There is no explanation for this occurrance. One might speculate that the transparent group took more time looking at the graphics than the other groups, although one student commented in a post study discussion that she was unaware of any graphics being there as she read, suggesting that she read right through the graphics. We venture to guess that the lower comprehension scores on for the run-around text group might be because the text is more difficult for the eye to follow due one of three possible reasons: 1) there are larger gaps of white space that the eye must jump across to continue reading, 2) there are variations in the amount of white space that the eye must jump across to continue reading, or 3) the text justification might interfere with reading continuity.

Irregular lines of text around a graphic and graphics placed over text did not confuse the readers in this study. The new enhancements currently available in desktop publishing software, particularly the wrap-around features, were not found to inhibit reading.

Because a significant difference in both reading speed and comprehension was found between the run-around and wrap-around treatment groups in a prior study, we suggest replication of this study. Further, we suggest that subjects in each of the three treatment groups be quizzed about their recollection of the graphics to see if they actually look at the graphics as they read or if they concentrate on the text alone. Because graphics are used for different reasons, such as decoration versus information, it could be important to know whether the subjects actually look at the decorative graphics. It is possible that subjects' reading speed and comprehension with the three text-wrap configurations could vary dependent upon the type of graphic used.

Future studies should consider perceptual principles such as proximity, similarity, continuity, and closure. These four processes, by which the mind organizes meaning, depend on how physically close the objects are, how similar they are, whether there is a continuous line to guide the eye, and whether the minimal amount of information is present that is necessary to obtain meaning or closure. Reading speed and comprehension are directly affected by the way the mind organizes meaning from the placement of graphics and text.

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